II. Amendments to the Claims

This listing of claims replaces without prejudice all prior versions and listings of claims in the application:

Listing of Claims:

Claims 17-41 (Cancelled)

Claim 42 (New) Apparatus configured for controlling a hydraulic actuator in an injection molding machine having a system control processor performing overall process control of the injection molding machine, said apparatus comprising:

a microcontroller configured to control the operation of a hydraulic control valve that regulates a supply of hydraulic fluid to the hydraulic actuator to control movement thereof, the microcontroller being remotely located from the system control processor and responsive to command signals from the system control processor, the command signals received by the microcontroller being configured to cause local control of the hydraulic control valve, said microcontroller generating control signals for communication to the hydraulic control valve in response to the command signals;

a communications link configured to connect said

microcontroller to the system control processor and to the hydraulic control valve, the communication link being configured to carry bi-directional communications;

a sensor configured to monitor the hydraulic actuator and send, in response to an operational condition of the hydraulic actuator, feedback signals to the microcontroller; and

a memory associated with the microcontroller and configured to store a control program, said command signals, and said and feedback signals, said memory also being configured to store operating characteristics of at least one of said hydraulic control valve and said hydraulic actuator,

said microcontroller being configured to use the stored operating characteristics locally in said control program to generate control signals that perform closed-loop control of the hydraulic actuator.

Claim 43 (New) The apparatus according to Claim 42, wherein said microcontroller is configured to operate a control program that uses the stored operating characteristics and feedback signals to (i) compensate for a non-linear characteristic of the hydraulic actuator, and (ii) generate compensated control signals that provide substantially linear operational control of the hydraulic control valve.

Claim 44   (New)   The apparatus according to Claim 42,
further comprising a plurality of pressure sensors coupled to the
hydraulic control valve and configured to (i) monitor pressure
going into and coming out of the hydraulic control valve, and (ii)
generate a pressure feedback signal that is provided to the
microcontroller.

Claim 45   (New)   The apparatus according to Claim 44,
wherein said stored characteristics correspond to hydraulic fluid
flow vs. hydraulic valve stroke at a predetermined pressure drop,
and wherein said microcontroller is configured to execute a control
program, stored in the memory, that references said pressure
feedback signals and said stored characteristics to calculate a
compensated flow rate using flow rate linearization, said
microcontroller providing the compensated flow rate to the
hydraulic control valve as a control signal configured to perform
control of the hydraulic actuator.

Claim 46   (New)   The apparatus according to any one of
Claims 42 and 43, wherein said stored characteristics correspond to
at least one of:

static and dynamic friction of a machine control axis;

a natural frequency of a machine control axis at
different positions of the hydraulic actuator; and

operational parameters determined by the local microcontroller.

Claim 47 (New) The apparatus according to any one of Claims 44 and 45, wherein said hydraulic control valve comprises first and second proportional valves configured to control the flow of hydraulic fluid through a pair of hydraulic lines coupled to the hydraulic actuator, and wherein said microcontroller uses feedback signals from the pressure sensor to control said first and second proportional valves to provide regenerative and non-regenerative control of said hydraulic actuator, whereby the pressure or flow of the hydraulic fluid into and out of the hydraulic actuator can be profiled.

Claim 48 (New) The apparatus according to Claim 47, wherein said microcontroller is configured to control said first and second proportional valves to independently adjust an orifice which meters hydraulic fluid into and out of each side of the hydraulic actuator.

Claim 49 (New) The apparatus according to Claim 47, wherein said microcontroller is configured to dynamically control the opening of said first and second proportional valves based on the required flow to the hydraulic actuator and the supply and load pressures.

Claim 50 (New)   The apparatus according to Claim 42, wherein said microcontroller is coupled to at least one of:

a hydraulic manifold configured to supply hydraulic fluid to said hydraulic actuator;

said hydraulic actuator; and

said hydraulic control valve.

Claim 51 (New)   An injection molding machine including the apparatus of Claim 42.

Claim 52 (New)   A method of controlling a hydraulic actuator in an injection molding machine having (i) a system control processor, and (ii) a hydraulic control valve that regulates a supply of hydraulic fluid to a hydraulic actuator, comprising the steps of:

storing in a microcontroller, which is disposed remotely from the system control processor, a control program for controlling a movement of the hydraulic actuator;

storing in the microcontroller characteristic information corresponding to at least one of (i) the hydraulic control valve, and (ii) the hydraulic actuator;

providing to the microcontroller, and storing in a memory coupled to the microcontroller, feedback signals from at least one sensor which senses a performance characteristic associated with

the hydraulic actuator;

providing to the microcontroller, and storing in said memory, command signals from the system control processor;

said microprocessor using (i) said stored control program, (ii) said stored characteristic information, (iii) said stored command signals, and (iv) said stored feedback signals, to calculate control signals to control the hydraulic control valve; and

said microcontroller transmitting said control signals to the hydraulic control valve to cause movement of the hydraulic actuator.

Claim 53 (New) The method according to Claim 52, further comprising the step of:

said microcontroller transmitting said stored feedback signals from said microcontroller to the system control processor.

Claim 54 (New) The method according to Claim 52, wherein said hydraulic control valve comprises first and second proportional valves configured to control the flow of hydraulic fluid through a pair of hydraulic lines coupled to the hydraulic actuator, and further comprising the steps of:

said microcontroller calculating control signals for the first and said second proportional valves; and

said microcontroller transmitting said control signals to

the first and said second proportional valves.

Claim 55 (New) The method according to Claim 54, wherein said microcontroller controls said first and second hydraulic control valves to provide regenerative and non-regenerative control of said hydraulic actuator.

Claim 56 (New) The method according to Claim 52, further comprising the steps of:

said microcontroller calculating control signals for a plurality of hydraulic actuator valves; and

said microcontroller transmitting said control signals to said plurality of hydraulic actuator valves.

Claim 57 (New) The method according to any one of Claims 52, 54, 55, and 56, wherein said microcontroller controls said hydraulic control valve to linearize non-linear characteristics of said hydraulic actuator.